

Claims

1. A curable composition comprising:
 - 5 (i) a uv curable component;
 - (ii) a component for initiating cure of the uv curable component;
 - (iii) an opacifying component which has a first colour which is sufficiently transparent to uv light so as to substantially unaffected cure of the uv curable component and which is activatable to change colour to a second colour which is sufficiently opaque to render the cured product of the composition substantially opaque to visible light; and
 - (iv) an adhesion-promoting component.
- 15 2. A composition according to Claim 1, wherein the composition is capable of curing through a volume of at least about 1 mm.
3. A composition according to Claim 1 or Claim 2, wherein the composition is capable of curing radiation at a wavelength of at least 290 nm.
- 20 4. A composition according to any preceding claim further comprising an inorganic filler component.
5. A composition according to any preceding claim, wherein the composition is capable of curing in a time of less than about 15 seconds.
- 25 6. A composition according to any preceding claim wherein the uv curable component comprises an epoxy resin material.
- 30 7. A composition according to Claim 6, wherein the epoxy resin component is a member selected from the group consisting of cycloaliphatic epoxy resins; C₄-C₂₈ alkyl glycidyl ethers; C₂-C₂₈ alkyl- and alkenyl-glycidyl esters; C₁-C₂₈ alkyl-, mono- and poly-phenol glycidyl ethers; polyglycidyl

ethers of pyrocatechol, resorcinol, hydroquinone, 4,4'-dihydroxydiphenyl methane, 4,4'-dihydroxy-3,3'-dimethyldiphenyl methane, 4,4'-dihydroxydiphenyl dimethyl methane, 4,4'-dihydroxydiphenyl methyl methane, 4,4'-dihydroxydiphenyl cyclohexane, 4,4'-dihydroxy-3,3'-dimethyldiphenyl propane, 4,4'-dihydroxydiphenyl sulfone, and tris(4-hydroxyphenyl)methane; polyglycidyl ethers of the chlorination and bromination products of the above-mentioned diphenols; polyglycidyl ethers of novolacs; polyglycidyl ethers of diphenols obtained by esterifying ethers of diphenols obtained by esterifying salts of an aromatic hydrocarboxylic acid with a dihaloalkane or dihalogen dialkyl ether; polyglycidyl ethers of polyphenols obtained by condensing phenols and long-chain halogen paraffins containing at least two halogen atoms; phenol novolac epoxy resins; cresol novolac epoxy resins; and combinations thereof.

15 8. A composition according to Claim 6 or Claim 7 wherein the epoxy resin component is a cycloaliphatic epoxy resin, Bisphenol A epoxy resin, Bisphenol F epoxy resin and combinations thereof.

20 9. A composition according to any one of claims 6 to 8, wherein the epoxy resin component is used in an amount of up to about 98 percent by weight of the total composition.

25 10. A composition according to any preceding claim wherein the opacifying component comprises a lactone in which an aromatic ring is fused to the lactone ring.

30 11. A composition according to any preceding claim wherein the component for initiating cure of the curable component also participates in the colour change of the opacifying component.

12. A composition according to any preceding claim wherein the component for initiating cure of the curable component is an onium salt.

13. A composition according to any preceding claim wherein the adhesion promoting component comprises silane.

14. A composition according to claim 13 wherein the silane is selected from the group consisting of: cycloaliphatic silanes, epoxy silanes, and amino silanes and combinations thereof.

15. A composition according to any preceding claim wherein the composition further comprises a photosensitiser component.

16. A composition according to Claim 15, wherein the photosensitiser component is selected from the group consisting of thioxanthones, anthracene, perylene, phenothiazine, 1,2 benzathracene, coronene, pyrene, tetracene and combinations thereof.

17. A composition according to Claim 15 or Claim 16 wherein the photosensitiser is a thioxanthone.

18. A composition according to any one of Claims 15 to 17 wherein the photosensitiser is used in an amount within the range of about 0.01 to 1 percent by weight of the total composition.

19. A composition according to any preceding claim wherein component for initiating cure of the uv curable component is present in an amount within the range of about 0.1 to about 2 percent by weight of the total composition.

20. A composition according to any preceding claim, further comprising a dye or pigment.

21. A smart card module assembly, comprising:
a carrier substrate dimensioned to receive a die;
a die having two surfaces, a first of which having bond pads disposed thereon and a second of which dimensioned for placement on the carrier substrate, wherein the second surface of the die is disposed on the

carrier substrate so that the bond pads on the first surface of the die are in a position relative to the bond pads on the carrier substrate to make electrical connection therewith by way of the wire connectors;

5 a plurality of bond pads, some of which being positioned on one surface of the die and others of which being positioned on the carrier substrate;

 a plurality of wire connectors; and

10 a composition according to any preceding claim, wherein the second surface of the die is disposed on the carrier substrate so that the bond pads on the first surface of the die are in a position relative to the bond pads on the carrier substrate to make electrical connection therewith by way of the wire connectors, and wherein the composition is disposed over at least a portion of the smart card module assembly so as to cover the wire bond connections established.

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22. A smart card comprising:

 a plastic card; and

20 a smart card module assembly of Claim 21 having been exposed to radiation in the electromagnetic radiation at a wavelength of at least 290 nm, encased in the plastic card.

23. A method for the attachment of an integrated circuit to a carrier substrate, the steps of which include

25 applying a composition according to any one of Claims 1 to 20 to the carrier substrate;

 activating the composition prior to or after application thereof through exposure to radiation in the electromagnetic spectrum; and

 positioning the integrated circuit onto the circuit board and establishing electrical interconnection therebetween; and
30 optionally, curing the composition at a temperature between 60 and 140°C.

24. Use of a composition comprising:

 (i) , , a uv curable component;

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- (ii) a component for initiating cure of the uv curable component;
- (iii) an opacifying component which has a first colour which is sufficiently transparent to uv light so as to substantially unaffect cure of the uv curable component and which is activatable to change colour to a second colour which is sufficiently opaque to render the cured product of the composition substantially opaque to visible light,
as an encapsulant for encapsulating electronic components.

10 25. Use of a composition according to any one of Claims 1 to 20 as an encapsulant for encapsulating electronic components.